

### Claims

The following listing of claims replaces all prior versions.

1. (Currently amended) An optical switch, comprising:
  - a substrate;
  - a loss element having a signal loss;
  - a rare earth doped gain element optically connected in series with the loss element, the rare earth doped gain element operable to produce a signal gain in response to an optical pump; and
    - an optical pump source operably connected to the rare earth doped gain element, the optical pump source operable to produce the optical pump in an ON state and no optical pump in an OFF state;
  - in which the loss element is configured to provide a predetermined signal loss and the rare earth doped gain element is configured to provide a predetermined signal gain, in which the absolute value of the signal gain and the absolute value of the signal loss are about equal.
2. (Original) The optical switch of claim 1, in which the loss element comprises a waveguide including a core and a cladding, the cladding at least partially surrounding the core, in which the core is doped with at least one species of rare earth ion in the range of 5 to 75 wt %.
3. (Original) The optical switch of claim 2, in which the at least one species of rare earth ion is  $\text{Er}^{3+}$ .
4. (Original) The optical switch of claim 2, in which the at least one species of rare earth ion comprises  $\text{Er}^{3+}$  and  $\text{Yb}^{3+}$ .
5. (Original) The optical switch of claim 2, in which the cladding is doped with at least one species of rare earth ion.
6. (Original) The optical switch of claim 1, in which the loss element comprises one of a rare earth doped waveguide, an un-doped waveguide, and a neutral density filter.

7. (Original) The optical switch of claim 1, in which the rare earth doped gain element comprises a waveguide including a core and a cladding, the cladding at least partially surrounding the core, in which the core is doped with at least one species of rare earth ion in the range of 5 to 75 wt % and in which the waveguide core is connected to receive optical pump power of a wavelength that stimulates the at least one species of rare earth ion.

8. (Original) The optical switch of claim 7, in which the at least one species of rare earth ion is  $\text{Er}^{3+}$ .

9. (Original) The optical switch of claim 7, in which the at least one species of one rare earth ion comprises  $\text{Er}^{3+}$  and  $\text{Yb}^{3+}$ .

10. (Original) The optical switch of claim 7, in which the core includes silver atoms.

11. (Original) The optical switch of claim 7, in which the cladding is doped with at least one species of rare earth ion.

12. (Original) The optical switch of claim 7, in which the rare earth doped gain element is in an ON state when the optical pump power is coupled to the gain element.

13. - 20. (Canceled)

21. (Previously presented) The optical switch of claim 1, in which the gain element is switchable between an ON state and an OFF state.